

## TRIP D - LITTLE FALLS AREA TO TRENTON GORGE

Purpose: The trip was arranged to permit observation of salient structures and the stratigraphy of formations in this area from the Precambrian through most of the Trenton group. In the sections observed there is evidence for the existence of an Adirondack arch, extending southwest through the Little Falls area.

Acknowledgments: Both the itinerary and the information in the field guide are heavily dependent on the work of Marshall Kay, particularly where the Trenton group is involved. For the Little Falls quadrangle the older work of H. P. Cushing has been used, and James R. Dunn, who has recently remapped the area, helped with the selection and explanation of localities in the field, and provided the summary of its geology for the guidebook. Donald W. Fisher helped with advice in the field, particularly regarding the extent to which Canadian formations are found in this area, and criteria for their identification.

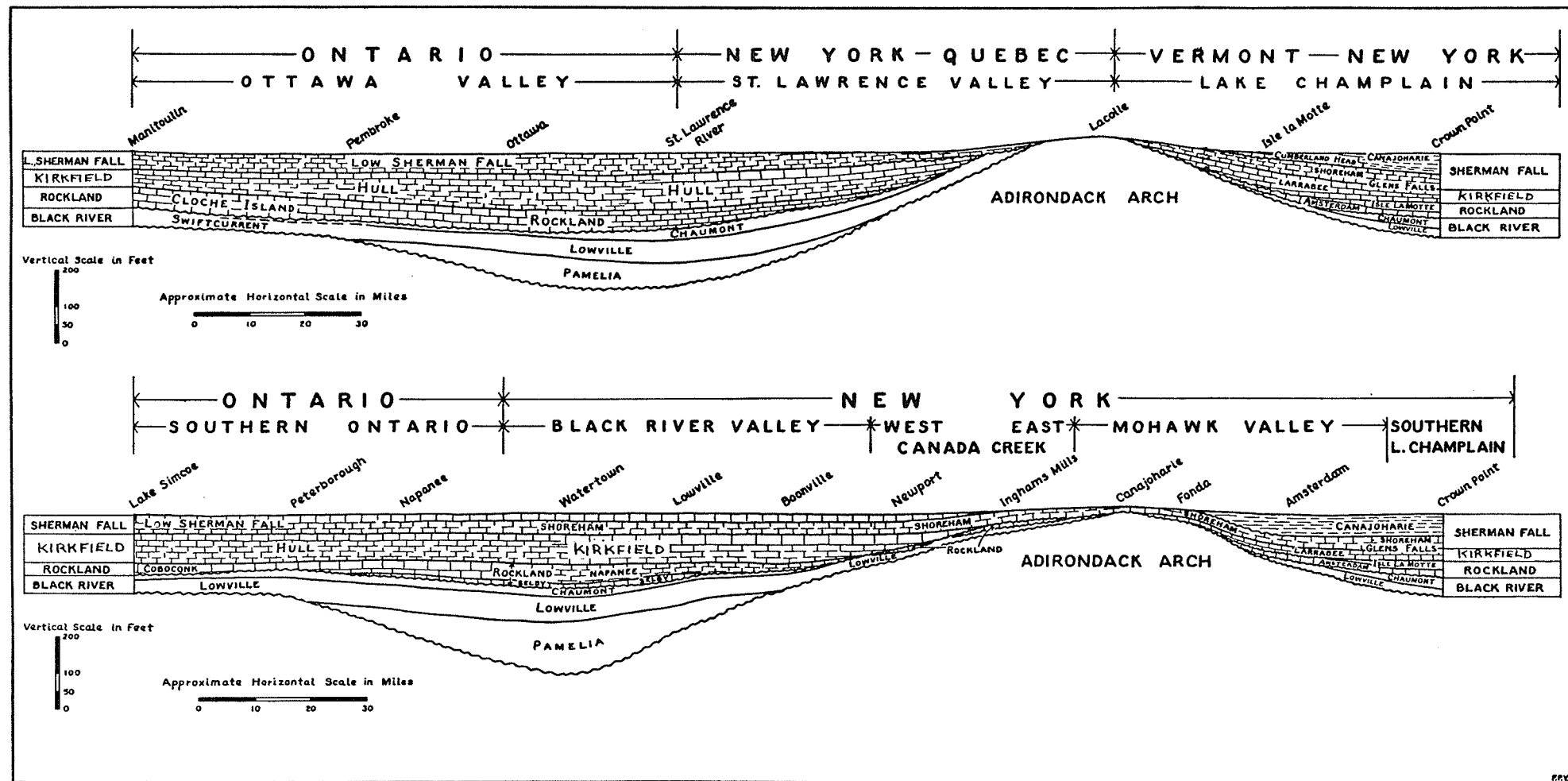
General: The structural behavior of an arch extending southwestward from the south central Adirondacks through the Little Falls - Canajoharie area affected the types of sediment deposited, and whether or not any was deposited (or at least preserved) during the first half of the Ordovician period. Canadian formations, subject to intermittent warping during their deposition in the eastern Mohawk Valley, extend only as far west as Little Falls (Fisher, 1954). Of the Black River group, 230 feet thick in the Black River Valley, only the Lowville limestone reaches this area, and it is absent from Canajoharie eastward to the Amsterdam area (Young, 1943, and Fisher, 1954). Of the Trenton group, the lower formations (Rockland and Kirkfield) thin southeastward toward the arch, and are missing at Canajoharie where the Shoreham rests directly on Canadian strata (Kay, 1953).

The Shoreham is the youngest Ordovician formation to extend as a limestone around the south flank of the Adirondacks. The overlying Denmark, mostly limestone at Trenton Falls, changes eastward through the Dolgeville facies in the Little Falls quadrangle, to the much thicker Canajoharie shale of the eastern Mohawk Valley. The Cobourg similarly undergoes a facies change eastward, thickening and becoming the lower member of the Utica shale, if this may be called Utica (Kay, 1953, p. 46). The influx of argillaceous sediment from the east accumulated in greater thickness east of the arch, suggesting more rapid subsidence there than on the arch and westward from it, and the arch acted as a facies barrier

during Denmark time. The muds spread westward across the arch during Cobourg time, though at Trenton limestone is found. Above the Cobourg, the Utica and younger shales indicate that the entire region was depressed and tilted southeastward, the direction in which the shales thicken. Details of this history are discussed in Kay (1953), pp. 74-76).

Selected References:

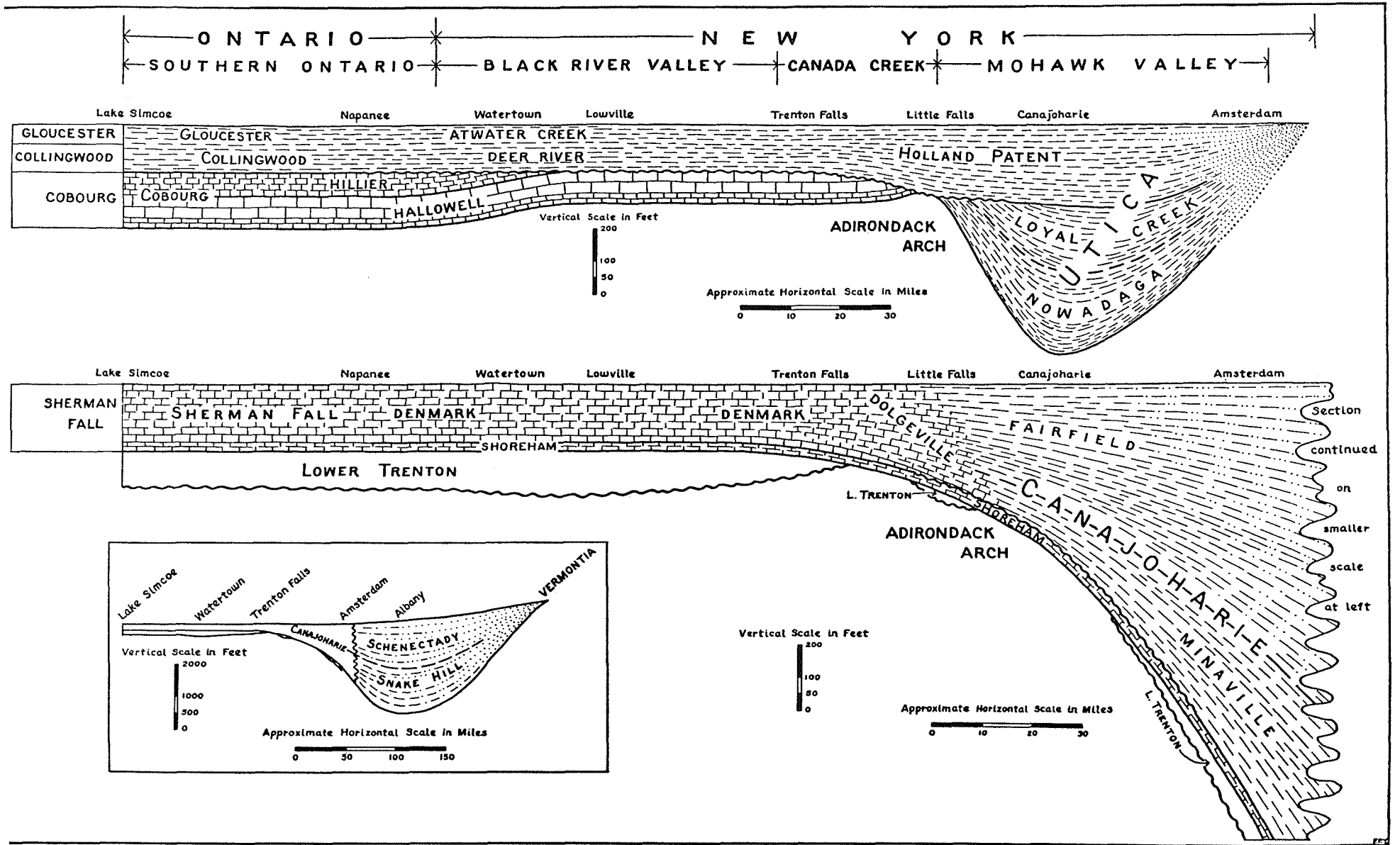
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RESTORED SECTIONS OF LOWER TRENTON FORMATIONS ACROSS THE ADIRONDACK ARCH

From Marshall Kay's "Stratigraphy of the Trenton Group"  
 Geol. Soc. America Bull., v. 48, 1937

Note: As suggested by Kay in later publications, "Kirkfield" has been substituted for "Hull" in the standard columns and in the Black River Valley, on this chart.



RESTORED SECTIONS OF HIGHER TRENTON FORMATIONS FROM CENTRAL ONTARIO TO THE HUDSON VALLEY

From Marshall Kay's "Stratigraphy of the Trenton Group"  
Geol. Soc. America Bull., v. 48, 1937

TRENTON LITHOLOGIES

Black River valley	Trenton Falls and Gravesville	Poland	Middleville	East Canada Creek	Canajoharie	Amsterdam
LOWER COBOURG A/B	Steuben A	? absent ?	part of UTICA	Part of UTICA	part of UTICA	part of UTICA
	Rust B	B-C ?-D?-	E	E	E	E
DENMARK B	Russia CD	Russia CD	E	E	CANAJO- HARIE E	CANAJO- HARIE E
	Poland C	Poland C	Dolgev'l D	Dolgeville D		
SHOREHAM B	Rathbun B	Rathbun B	Rathbun B	? absent ?	? absent ?	?
	SHOREHAM B	SHOREHAM B	SHOREHAM B	SHOREHAM AB	SHOREHAM AB	SHOREHAM B

Table D-1

- A - coarse-textured calcite sandstone, calcarenite
- B - shell limestone (coquina), fossiliferous shale, and calcilutite
- C - dark, dense fossiliferous limestone and calcareous shale
- D - sparsely fossiliferous argillaceous calcilutite and laminated shale
- E - black, finely-laminated, graptolitic shale

## Summary of the Geology of the Little Falls Quadrangle

by James R. Dunn

## Stratigraphy

Precambrian

The oldest rocks exposed in the Little Falls area are the Grenville complex of pre-Cambrian age. With the exception of some diabase, all of the rocks are gneiss. The predominant type is the greenish to bluish gray "quartz syenite" gneiss or "granite" gneiss which is so common in the Grenville province. However, distinctly metasedimentary types are represented 4 miles north-northeast of Little Falls where typical Grenville marbles, garnetiferous gneisses and amphibolites outcrop. A large diabase dike which occurs just east of Little Falls is not metamorphosed and does not cut the overlying Paleozoic rocks.

Little Falls Formation

Lying unconformably on the Grenville throughout the area is the Little Falls formation of Upper Cambrian or Lower Ordovician age. It is largely a tan to buff weathering, sandy, cherty, medium grained dolomite. Sandstones and conglomerates occur at its base where it is in contact with the pre-Cambrian rocks. The thickness of the Little Falls formation is extremely variable in the area because of the rugged nature of the Grenville erosion surface. The Little Falls formation may feather out to nothing against the Adirondack highland to the north and be from 300 to 400 feet thick at Little Falls.

The Little Falls dolomite is particularly interesting because it contains abundant water-clear quartz crystals which are known as Little Falls or Herkimer County "diamonds." Of additional interest is the occurrence of cryptozoon beds (algal reef growths), anthraxolite (a coal-like residue of a former fluid carbohydrate or hydrocarbon), glauconitic zones and local concentrations of galena, pyrite, marcasite and sphalerite (locally white).

Canadian Rocks

Canadian rocks of Lower Ordovician age have limited outcrops at Little Falls and East Canada Creek where they are from 40 to 50 feet thick. They die out at a mile to

two miles north of this. They are represented by several formations and are transitional in lithologic type between the dolomites below and the Black River limestones above. They consist of blue gray to tannish gray, sandy, glauconitic, fine to medium grained, limestones, dolomites and intermediate types.

### Lowville Formation

The Lowville formation is a white weathering, dove gray on fresh surface, fine grained to cryptocrystalline limestone of Middle Ordovician age (Black River). It averages about 40 feet at the north to about 20 feet to the south and east. It contains abundant Phytopsis (worm borings), straight cephalopods, trilobites and brachiopods.

### Trenton Formations

The Trenton formations, with their type locality at Trenton Falls gorge just northwest of the Little Falls quadrangle, are well represented in the area. All of the Trenton units are calcareous and are shades of medium to dark gray. Most are abundantly fossiliferous with brachiopods and trilobites most common.

The lowest Trenton units are the Kirkfield and Shoreham formations which are about 60 to 80 feet thick. They consist of medium to coarse grained limestone layers usually 1 to 10 inches thick, separated by thin shaly beds up to 1 inch thick.

The Denmark formation has the Poland member as its lower unit. The Poland member is a fine-grained, dark gray limestone which is about 120 feet thick west of the Little Falls graben and very much thinner to the east. The bedding planes are from 1 to 4 inches thick with thin shale parting between. Fossils, although locally abundant, are generally not as common as in other Trenton rocks.

The Russia member of the Denmark formation occurs in the northwestern part of the Little Falls quadrangle but rapidly changes south and east to the calcareous shales and barren limestones of the Dolgeville Facies. The Russia, like the lower units, consists of limestone layers with shale intercalations. It is coarser than the Poland member, and is more fossiliferous.

Trenton shales are the uppermost Ordovician unit of the area. The Dolgeville facies, the Canajoharie and the Utica

formations are all dark gray calcareous shales and are lithologically indistinguishable. Tribolites and graptolites are common.

### Late Dike Rocks

Two thin vertical dikes can be seen cutting the Little Falls formation at East Canada Creek near the power station about 1 mile north of Route 5. They are highly altered, but they are believed to be a potash-rich lamprophyric type called alnoite.

### Structure

The Grenville rocks are gneissose and are intensely folded. No detail has been obtained, but the metasedimentary strata which are north-northeast of Little Falls trend almost east-west.

The limestones overlying the Grenville dip about  $1\frac{1}{2}$  degrees westward at the northwestern part of the Little Falls quadrangle to about  $1\frac{1}{2}$  degrees southward at the south part of the quadrangle.

The most striking structural feature in the area is the series of zig-zag vertical faults which break the rocks into a series of horsts and grabens. The fault movements are probably along old pre-Cambrian lines of weakness which broke the overlying strata during a general and irregular uplift of the Adirondacks. The fault blocks moved independently and at different rates causing reversals in the direction of fault drag. The movement may have occurred throughout the Cambrian and Ordovician as suggested by radical horizontal changes in thickness and nature of the various formations in the immediate vicinity of Little Falls. A well, which was completed in March, 1960, on the southern extension of Little Falls-Dolgeville graben, showed an abnormal thickness of Trenton shale suggesting that the graben was active at that time. Interestingly enough, the change from Trenton limestone to Trenton shale is everywhere marked in this area by a zone of contorted bedding and bentonite. The correlation of volcanic activity producing volcanic ash, shaking of the crust (to cause the gravity (?) crumpling of soft beds), the change from limestone to shale and the great thickening of shales in the Little Falls graben is probably more than coincidental.



### Economic Geology

The principal economic rock assets in the area are limestone and gravel. Gravel is being quarried at several places along West Canada Creek. Limestone is quarried for crushed stone (Little Falls, Lowville, and Trenton limestones) and for dimension stone and agricultural lime (Lowville formation mainly). In addition, parts of the Trenton could possibly be used in the manufacture of portland cement.

Iron ore in the form of magnetite was mined 1 mile north-northeast of Salisbury and prospect pits have been cut into galena and sphalerite locally but with no apparent success.

## TRIP D. LITTLE FALLS AREA TO TRENTON GORGE

Road Log

Mileages in the following log should be considered approximate. They have been compensated for error in the recording odometer, but the guide-user's odometer is likely to be inaccurate, too.

With a group of this size it is essential that the buses be reloaded promptly at the end of the time allotted to each stop. Three blasts of the bus horn will be the five-minute warning. A single long blast will be the one-minute warning.

- 0.0 Leave campus driving north on Campus Road.
- 1.45 Turn right (E) at the T intersection.
- 2.6 Turn left (N) at bottom of hill, on Rte. 233.
- 3.0 Kames and/or crevasse fillings form partly wooded small hills on the Oriskany Valley floor to the right.
- 3.8 Turn right (E) on Rte. 5, in Kirkland hamlet.
- 6.8 Bear left (NE) on Utica truck Rte. 5A.
- 9.9 Continue on Rte. 5A through Yorkville.
- 12.4 Turn left (N) on arterial overpass. Sign: "Trenton 13".
- 12.9 Cross Mohawk River.
- 13.5 Cross New York State Barge Canal and turn right (E) to Thruway (sign).
- 14.8 Enter Thruway Toll gate. Go east, toward Albany.
- 18.4 Hills across the valley to the right (S) are the escarpment of the Clinton group, and are the northern edge of the Appalachian plateaus. Hills to the left (N) are underlain by Utica shale, and capped by the Frankfort shale.
- 25.2) Large road cuts in black, fissile Utica shale at left.  
25.8)
- 26.7 Knobby hills across the valley to the right (S) are terminal moraine of the Ontarian lobe, a last-gasp glacial advance in this area. This represents its easternmost extent.

- 27.1 To the left (N) in a large gravel pit are foreset beds of a gravelly delta. As its top elevation is about 520', it would be assigned to post-glacial Lake Amsterdam of Fairchild.
- 28.0 Exit Thruway toll gate at Herkimer.
- 28.1 Turn right (NE) on Rte. 28, toward Herkimer.
- 28.3 Turn left (N), following Rte. 28 toward Rte. 5.
- 28.5 Turn right (E), on Rte. 5.
- 28.9 Cross West Canada Creek, leaving Herkimer, and climb hill to the top of the 520-foot terrace along the north side of the Mohawk Valley.
- 33.9 To the left are large gravel pits in lenticular coarse gravel and sand beds.
- 36.1 In Little Falls turn right off Rte. 5 on Fourth Street.
- 36.2 Take first left, and then right on railroad overpass. Then turn left, following Rte. 167.
- 36.3 Following Rte. 167 right at station, and turn first left off Rte. 167, on E. Mill St. W. (Note: On the field trip the buses will not follow this turn if permission can be obtained to drive them to Lock 17.)
- 36.6 Turn right on S. William St. (to Lock 17). Across the bridge, turn left and continue to:
- 37.2 Parking area at Lock 17, on Moss Island.

STOP 1 Moss Island, in Little Falls, N. Y.

The bedrock here is quartzose syenite gneiss of Precambrian age, faulted up on the Little Falls fault block. The same rock forms the cliffs to the south, across the canal. The line of the top of the cliffs is approximately the unconformity on which the Cambrian Little Falls dolomite lies, though the dolomite is not visible from here, in the woods above the cliffs. This raised block of resistant rock formed the pre-glacial divide between the Hudson and St. Lawrence drainage basins. However, following melting back of the continental ice sheet to the extent that the Hudson and Mohawk valleys were open, and the St. Lawrence still dammed, this valley drained ice melt-water from the entire eastern Great Lakes (Lake Iroquois). This discharge, probably at least as large as the present Niagara River, cut down the divide here, resulting in its westward shift to Rome, N. Y.

Walk northward across Moss Island. Along most of the northern margin is a complex of enormous potholes cut when the post-glacial Great Lakes drainage spilled over Moss Island in a thundering cataract.

- 0.0 Leave Moss Island, and retrace to Rte. 5 via Rte. 167.
- 1.2 Turn right (E) on Rte. 5, from Rte. 167.
- 1.4 Road cut in Precambrian greenish-gray, brown-weathering syenite gneiss.
- 2.9 Downgrade toward the east, Rte. 5 crosses the Little Falls fault-line scarp. On the Little Falls block is Precambrian gneiss. East of the fault is Utica shale covered with glacial and alluvial deposits. Cushing estimates the displacement here at between 750 and 850 feet.
- 4.0)
- 4.4) To the left (N) are large gravel pits cut into the
- 4.6) side of the 460-foot terrace.
- 7.5 Turn left off Rte. 5 on "old Rte. 5" at the "Manor" sign.
- 7.8 Turn left off "old Rte. 5" on gravel road parallel to East Canada Creek.
- 8.0 To the left the bluff is the fault-line scarp of the Manheim fault, which will be seen at close hand at the Beardslee power station.
- 8.3 Fork in gravel road. Disembark from buses and walk on right (E) fork to power station. Buses will take left fork and continue for one half mile to T road junction where they will wait.

STOP 2 East Canada Creek gorge at Beardslee power station.

FOLLOW LEADERS CLOSELY PAST STATION. DO NOT ENTER STATION OR GO NEAR HIGH TENSION LINES AND TRANSFORMERS.

Water levels permitting, we will go down the steps by the station, cross the creek bed on a concrete wall, and hike for about one half mile up the gorge. Opposite the power station the Manheim fault is well exposed. The displacement is estimated by Fisher (1954, p. 78) to be about 400 feet.

Sulphides in the fault zone once led to an abortive attempt to open a lead mine. The upstream (upthrown) wall is Little Falls dolomite. At the base of the downstream (downthrown) wall are a few beds of the uppermost Shoreham limestone (coarse calcarenite) overlain by about 25 feet of the Dolgeville facies, interbedded barren limestones and dark shales between fossiliferous Trenton limestones and overlying black shale. Overlying the Dolgeville beds is the Canajoharie black calcareous shale, equivalent to the Denmark limestone of lower Trenton Gorge (Stop 6).

About 100 feet upstream from the fault are two thin (6") alnoite dikes bearing biotite phenocrysts. In the same locality the dolomite contains a greenish-gray chert bed about 8 inches thick, and an intraformational breccia bed several feet thick exposed on the wall beside the lower pool.

In the middle area of the gorge, opposite the old mill ruin, there are several large potholes loaded with the tools of their erosion. Just above the area of the potholes is 1 to 2-foot bed of contorted laminated sandy dolomite, with some cabbage-head forms attributed by Dr. Donald Fisher to cryptozoan. In this part of the gorge there are fractures and vugs containing calcite and quartz crystals, and anthraxolite (identified by Dr. James R. Dunn).

Upstream from the broad upper pool the uppermost 10 to 15 feet of the Little Falls formation is the "reddish zone", which contains graded sandstone and intraformational breccia beds. The overlying Lower Ordovician Tribes Hill formation is composed of fossiliferous limestone and dolomite, commonly muddy and sandy, with a "fretwork" weathered surface. One of the least inconspicuous of the fossils is a gastropod, *Ophileta* sp. The Tribes Hill formation, about 45 feet thick here (Fisher, 1954, p. 93), forms the ledges for some distance both down and upstream from the old dam.

Overlying the Tribes Hill with a distinct change in lithic type is Lowville limestone, of Black River age, a gray calcilutite. This appears below the newer dam, with its distinctive worm tube, *Phytopsis*. Here also there are several minor faults, and veins containing pyrite. There are some veins of anthraxolite and quartz crystals, along joint surfaces.

Return to buses by walking south next to the penstock until there is room to pass beneath it.

- 0.0 Leave upper gravel road junction and proceed west on gravel road.
- 0.5 Continue straight ahead from gravel to paved road.
- 2.4 Turn left on Road 42 past church on hill (left).
- 3.4 Full stop junction. Turn left (W), cross creek and uphill.
- 3.8 Turn right (N) to join Rte. 167 going to Dolgeville.
- 5.3 Bluff in the distance to the left (W) is the fault-line scarp of the Little Falls fault. Little Falls dolomite forms the bluff, faulted up against the Utica shale (down on the east).
- 8.15 In Dolgeville, turn left on Elm Street and park. Disembark for lunch.

STOP 3 Lunch stop. Lunch is being served by the Rebeccas of Dolgeville in their hall to the rear of the brown frame building on the southwest side of the street.

- 0.0 Proceed ahead (NW) on Elm Street to N. Helmer Avenue, and turn right. Continue on N. Helmer Ave., after 1 block joining Rte. 29 northward out of town toward Salisbury Center.
- 1.7 Ahead and to the left (W) is the Little Falls fault-line scarp. Precambrian Grenville rock underlies the hills, with down-faulted Trenton limestone and shale opposite on the east.
- 3.1 Intersection in Salisbury Center. Bear left, following Rte. 29 westward.
- 5.1 Salisbury. Turn right (NW) on Road 36.
- 5.4 T junction. Continue straight on Road 36.
- 7.1 Diamond Hill. Disembark, and walk downstream on the near side of Spruce Creek, to the right of the old bridge.

STOP 4 Basal Cambrian unconformity. Little Falls fm. on Grenville gneiss.

Conglomeratic basal beds of the upper Cambrian Little Falls formation overlap northward a hill of Grenville quartzose gneiss. Upstream the gneiss occupies an elevation 100 feet or more higher than the basal beds of the Little Falls lying on the gneiss at the foot of the cascades. The initial dip of the Little Falls beds is noticeable.

Shoreham limestone crops out only one half mile WNW at an altitude of 1460 feet. Inasmuch as Grenville gneiss crops out on Diamond Hill at least as high as 1360 feet, only about 100 feet are available for all the formations between the Shoreham and Precambrian. The Little Falls alone is 450 feet thick in cliffs south of the Mohawk River at Little Falls.

MR. D. H. BURRELL, THE OWNER OF THIS PROPERTY, HAS GIVEN US PERMISSION TO BE HERE, AND REQUESTED THAT NO ONE EXCAVATE IN SEARCH OF LITTLE FALLS "DIAMONDS". BE ESPECIALLY CAREFUL NOT TO DEFACE THE NATURAL BEAUTY OF HIS PROPERTY.

- 0.0 Leave Diamond Hill and return to Salisbury.
- 1.9 Turn right (W) in Salisbury, on Rte. 29. The road west climbs up through the stratigraphic section from Little Falls to Utica shale, and back down again as it descends into West Canada Creek Valley at Middleville.
- 5.7 View west into West Canada Creek Valley. Harter and Hasenclever Hills, on the opposite side of the valley, are underlain by Utica shale, capped by Frankfort shale. Precambrian gneissoid syenite crops out in the bottom of the valley at Middleville.
- 8.25 Road cut in Kirkfield and Shoreham limestones.
- 8.6 Road cut in Little Falls dolomite.
- 9.5 Middleville traffic light. Turn right (NW) on Rte. 28.
- 11.3 On the near side of an old house directly across the road from a barn, turn right, but not sharp right, off Rte. 28, and proceed uphill.
- 11.6 At junction with gravel road, forking downhill to left, stop and disembark, and walk down the gravel road to "City Brook" (Wolf Hollow Brook). This locality is known as Old City.

STOP 5 Stratigraphic section on "City Brook" (Wolf Hollow Creek).

This section, discussed by Kay (1953), includes much of the Little Falls dolomite, and extends upward through the Lowville, Kirkfield, Shoreham and well into the Denmark formation.

The top of the Little Falls formation is the top of the sandy dolomite stratum in the bed of the creek immediately upstream from the bridge at Old City. *Cryptozoon* is abundant in four feet of dolomite about 60 feet below the top of the formation.

The Canadian strata, present at Stop 1 (45 feet of Tribes Hill fm.), are missing between the Little Falls and Lowville on City Brook.

The Lowville formation forms the lower 26 feet of the cascades and is exposed in the small quarry south of the creek. The lower member, seven feet thick here, is tan-weathering, gray-brown, medium textured, heavy-ledged, tough, sandy and muddy limestone. The upper member, here 19 feet thick, is light-gray-weathering, medium gray calcilutite with some shale partings. A 3-inch metabentonite bed can be seen approximately at the base of the upper member, well exposed about 3 feet above the floor of the quarry. The Lowville is the only member of the Black River group present.

The Rockland limestone is not present here, even though it is 13 feet thick above the Lowville at Ingham Mills on East Canada Creek, and 8 feet thick in a quarry one mile northwest of Newport.

The Kirkfield formation, overlying the Lowville here, is interbedded thin-bedded limestone and black calcareous shale, abundantly fossiliferous, about 45 feet thick at City Brook. A metabentonite bed is weathered far back in a recess part way up the falls, about 8 feet above the formation base. The uppermost beds are thick calcarenite strata, some of which have para-ripples.

The Shoreham limestone, overlying the Kirkfield, is 45 feet thick here. The lower part is interbedded thin-bedded shell limestone and calcareous shale, with the trilobite *Cryptolithus* common a few feet above the base on City Brook. The upper 9 feet, called the Rathbun member by Kay (1953, p. 44), has a basal ledge of calcarenite, above which are interbeds of calcilutite, coquina-calcarenite, and calcareous shale. Below the upper bridge is a zone where the bryozoan



Prasopora is large and common.

The basal Denmark beds, of the Poland member, appear in a ledge to the right of the creek as one proceeds about 100 feet upstream from the upper bridge. They are black, irregular, impure bituminous limestone beds in which the cephalopods Geisonoceras, Endoceras, and Trocholites are abundant. About 3 feet above this Trocholites zone is the lowest Poland metabentonite. In its lower 50 feet here the beds are typically Poland in rock type, heavy-ledged, fine-grained, fossiliferous limestone, though there are some relatively barren, knobby-surfaced calcilutite beds. Farther upstream are barren, fine-grained limestone beds intercalated with black calcareous shale, typical of the Dolgeville facies, probably equivalent to the lower Russia member (upper Denmark) at Trenton Falls (Kay, 1953, p. 53).

- 0.0 Leave upper bridge area of City Brook and return to Rte. 28.
- 0.5 Turn right (W) on Rte. 28.
- 2.1 The conspicuous terrace across the valley to the left (SW) is the result of resistant limestone beds at the base of the Poland member of the Denmark limestone (Kay, 1953, p. 105).
- 4.4 Northwest of Newport, there is a low-level floodplain terrace to the right (NE). Higher knobs northeastward are dissected remnants of once continuous varved clay overlain by sand. The top of the clay is persistent at about 800 feet, and the top of the sand at about 1000 feet (Kay, 1953, p. 97). They are post glacial lacustrine sediments.
- 5.2 The basal Poland limestone stratum plain terrace continues across the river to the left (SW).
- 6.9 Continue on Rte. 28 through Poland.
- 7.2 Knobs to the right (NE) are probably kames. In some cases, at least, they are composed of sand and gravel (Kay, 1953, p. 97).
- 8.3 Bear right, continuing on Rte. 28 across West Canada Creek.
- 11.35 Cross West Canada Creek.
- 13.4 Go straight ahead, leaving Rte. 28 which curves left, then turn sharp right (NE) on road to Trenton Falls.

14.35 Stop at intersection in Trenton Falls hamlet, and disembark. Cross the bridge over West Canada Creek, keeping in narrow file on the upstream side of the bridge. Turn left at east end of bridge, and descend to ledges.

STOP 6 Lower end of Trenton Gorge.

The ledges upstream from the bridge are in the lower part of the Poland member of the Denmark formation, and are only a few feet higher than the lowest beds of the Trenton Falls section which Kay has described (1953, p. 27). Here the Poland member is composed of heavy ledges of black, fine-grained, fossiliferous limestone interbedded with fossiliferous calcareous shale. Upstream one hundred yards or so can be seen the two metabentonite beds, about nine feet apart, weathered back into the wall of the gorge. These are the second and third metabentonites in the Poland. The Poland limestone ledges in the stream channel above the bridge are equivalent to the Canajoharie shale above the thin remnant of the Dolgeville facies downstream from the fault at Beardslee power station (Stop 1).

0.0 Proceed north from Trenton Falls hamlet toward Niagara Mohawk property.

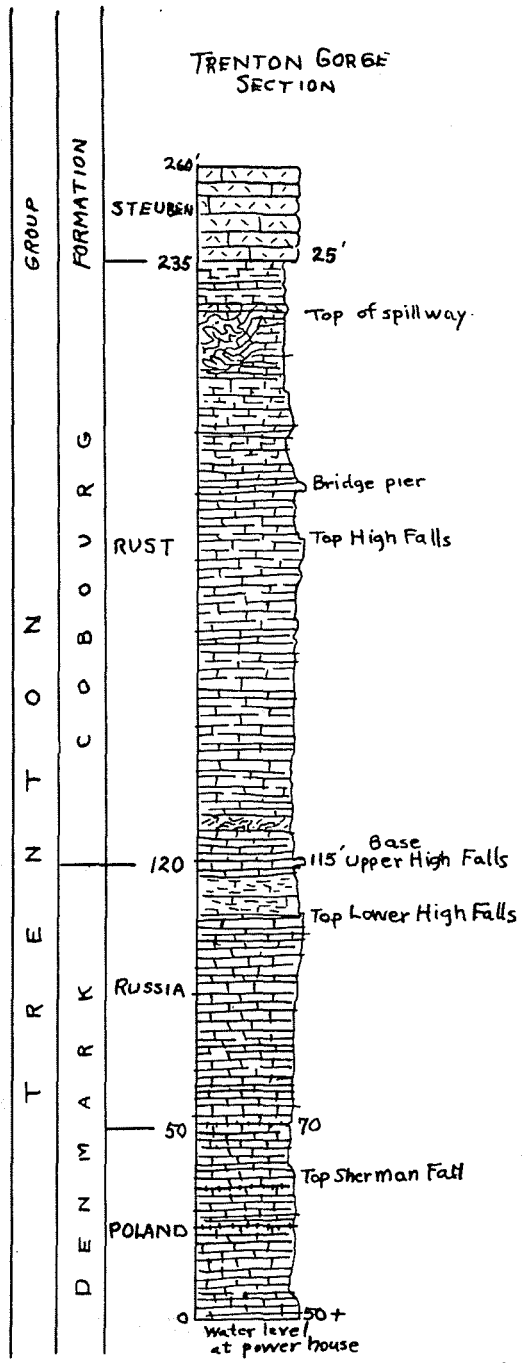
0.35 Turn right, then left around monument at the transformer station.

0.4 Turn left before reaching gate, toward parking area by barn. Disembark, and walk up the road through the gate.

STOP 7 Middle Trenton Gorge.

The ledges exposed in and beside the road are in the upper part of the Rust member of the Cobourg formation. About 300 yards up the road one can look down into the gorge to the right (E) and see the brink of the upper high falls. The base of the Cobourg is at the base of the upper high falls. The Rust member, 115 feet of thin limestone beds intercalated with shale, forms most of the gorge wall here.

Just below the parking area and garage-like building at the dam, an abandoned road leads diagonally down the wall of the gorge toward the base of the dam. The weathered road cut is abundantly fossiliferous. From the bottom of this



From Kay, 1953, p. 26

road, above the penstocks below the dam, one can look across the gorge to see the 15-foot contorted zone just below the lip of the spillway. This zone is discontinuous, but appears in varying thicknesses at this horizon in many places on the gorge wall. It is the result of a submarine slide. This is indicated by the coarse calcarenite bed immediately overlying the contorted zone, which fills in hollows and around fragments at its base, and has a comparatively even upper surface.

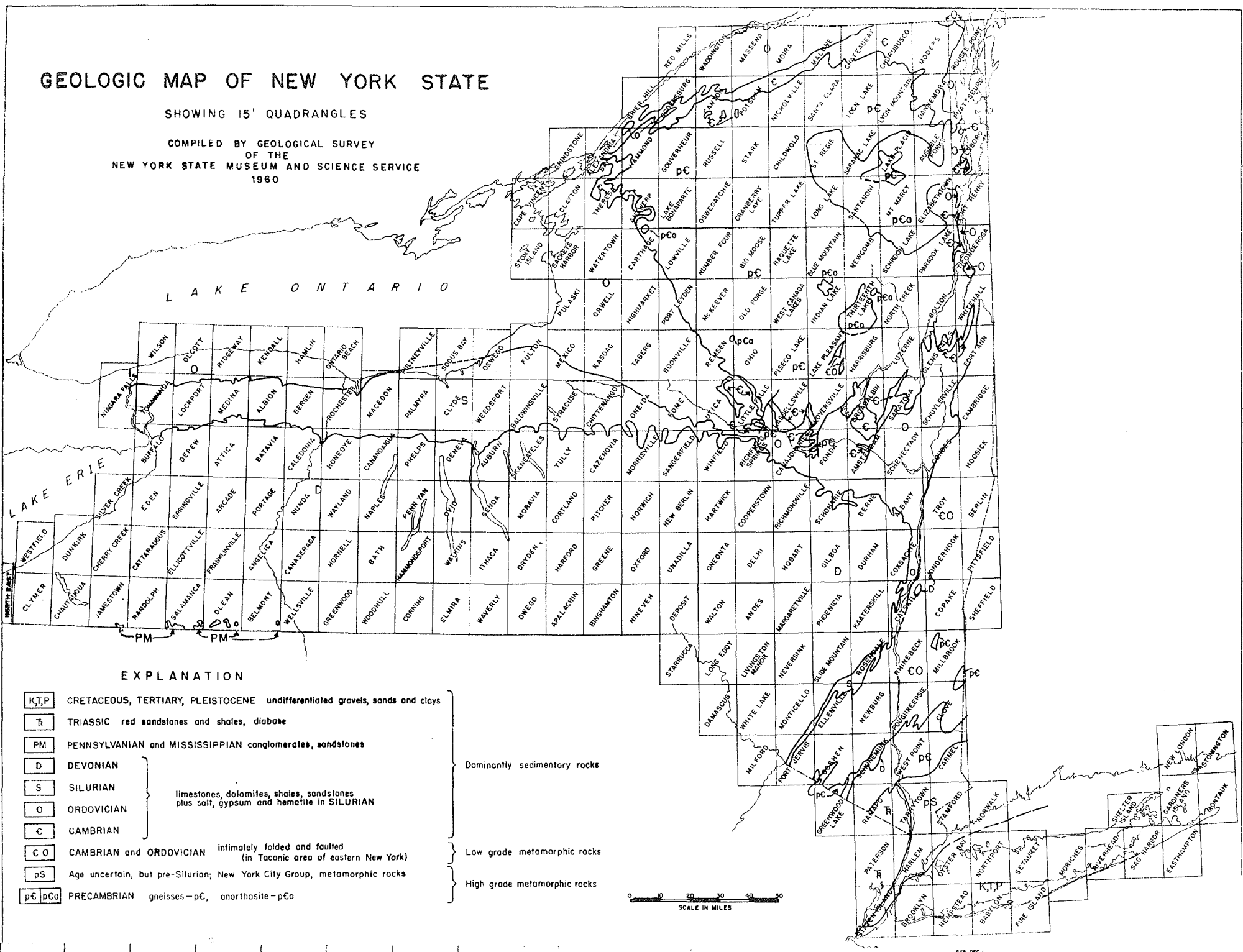
At the top of the eastern gorge wall, above the dam, are the thick beds of the Steuben limestone, the upper member of the Cobourg. In the vicinity of East Canada Creek (Stop 1) the entire Cobourg formation and most of the Denmark have changed facies to black calcareous shale in which the contact between the Canajoharie and Utica shales is obscure.

- 0.0 Retrace through Trenton Falls hamlet to Rte. 28.
- 1.5 Turn right (W) on Rte. 28.
- 2.4 Turn left (S) on Rte. 12.
- 8.4 Crest of Marcy Hill, capped by lower Cincinnati Frankfort shale. The lower slopes of the hill, both north and south, are underlain by Utica shale. Ahead (S) is the Mohawk Valley.
- 10.9 Bear right, leaving Rte. 12. Sign points to Rte. 5A.
- 12.7 Overpass Thruway and barge canal.
- 13.9 Turn right on Rte. 5A, at south end of arterial highway.
- 16.4 Continue on Rte. 5A beyond Yorkville, bearing left.
- 19.5 Turn right (W) at end of Rte. 5A, on to Rte. 5.
- 22.5 After crossing Oriskany Creek, in Kirkland hamlet, turn left on Rte. 233.
- 23.7 Turn right off Rte. 233, and proceed up hill.
- 24.8 Turn left (S). This is the first left after leaving Rte. 233.
- 26.3 Hamilton College campus.

# GEOLOGIC MAP OF NEW YORK STATE

SHOWING 15' QUADRANGLES

COMPILED BY GEOLOGICAL SURVEY  
OF THE  
NEW YORK STATE MUSEUM AND SCIENCE SERVICE  
1960



## EXPLANATION

- |              |                                                       |                                           |                                                                        |
|--------------|-------------------------------------------------------|-------------------------------------------|------------------------------------------------------------------------|
| <b>K,T,P</b> | CRETACEOUS, TERTIARY, PLEISTOCENE                     | undifferentiated gravels, sands and clays |                                                                        |
| <b>R</b>     | TRIASSIC                                              | red sandstones and shales, diabase        |                                                                        |
| <b>PM</b>    | PENNSYLVANIAN and MISSISSIPPIAN                       | conglomerates, sandstones                 |                                                                        |
| <b>D</b>     | DEVONIAN                                              | } Dominantly sedimentary rocks            |                                                                        |
| <b>S</b>     | SILURIAN                                              |                                           |                                                                        |
| <b>O</b>     | ORDOVICIAN                                            |                                           |                                                                        |
| <b>C</b>     | CAMBRIAN                                              |                                           |                                                                        |
| <b>CO</b>    | CAMBRIAN and ORDOVICIAN                               |                                           | intimately folded and faulted<br>(in Taconic area of eastern New York) |
| <b>pS</b>    | Age uncertain, but pre-Silurian; New York City Group, | metamorphic rocks                         | } Low grade metamorphic rocks                                          |
| <b>pC</b>    | PRECAMBRIAN                                           | gneisses - pC, anorthosite - pCo          |                                                                        |
|              |                                                       |                                           | } High grade metamorphic rocks                                         |

SCALE IN MILES

